# Convective Severe Weather

- 3d. Given analyzed charts and diagrams, forecast convective severe weather elements with at least 75% accuracy based on a master solution.

# Thunderstorm Decision Tree Steps

- Unstable air. - The best method for determining airmass stability is to examine the temperature curve on a plotted Skew-T sounding.
- Trigger Mechanisms. - Low-level convergence is the trigger mechanism that is possibly the most important. The best tool for detecting boundaries close to your station and identifying convergence zones is the WSR-88D. Satellite is another tool  you can use to identify convergence zones on a synoptic scale. Streamline analysis is also a useful tool.

# Thunderstorm Decision Tree Steps

- Low Level Moisture. - In order to have thunderstorms you must have enough moisture in the lower atmosphere. Surface dewpoints > 65˚ F are usually a good indication of sufficient low level moisture. However, this is dependent on your location, airmass type and season.

# Thunderstorm Decision Tree Steps

- Preventive Factors. - The next step is to determine if there are any factors that will diminish thunderstorm development. Some factors that deter thunderstorm development include the following:
  - Strong subsidence; produces a mid-tropospheric inversion.
  - A strong vertical wind shear when updrafts are weak.
  - Upper level convergence

# Thunderstorm Decision Tree Steps

- Low-level cold air advection or high level warm air advection; stabilizes the atmosphere.

# Thunderstorm Decision Tree Steps

- Mid Level Moisture. - Dry air intrusion causes evaporative cooling around the cell's core, increasing the cores temperature contrast with the surrounding air and increases buoyancy. Slight decrease of moisture in the mid-level of the cloud assists in destabilizing atmosphere.
- Upper Level Divergence. - All Severe thunderstorms need an upper level exhaust mechanism or divergence aloft. This can be seen on the WSR-88D base velocity products as well as Upper Air charts.

# Thunderstorm Decision Tree Steps

- Severe Stability Index. - Remember the stability indices is a tool, the values you received may or may not be valid for your region, Use in conjunction with other parameter.

# Thunderstorm Decision Tree Steps

- Wet Bulb Zero Height. - In many cases when severe weather, such as hail and strong downburst winds, is suspected the damaging phenomena often fails to reach the surface.
  - Careful examination of these situations indicates that the Wet Bulb Zero (WBZ) height above the surface may be the best single index for discriminating the cases in which the damaging phenomena affects the ground.

# Thunderstorm Decision Tree Steps

- Studies suggest that a 10,500 foot high WBZ isoline provides an effective separation of areas where severe phenomena reach the surface and areas where they do not.
- Values between 7,000 feet and 9,000 feet indicate the most probable limits of severe weather phenomena at the surface.
- The Skew-T Pro or SHARP program offers the easiest method of obtaining the WBZ height.

# Thunderstorm Decision Tree Steps

- Storm Intensity. - Determine the strength of the convective gust and/or hailstone size. Evaluates the kinetic energy and the storm relative helicity using the SHARP.

# SEVERE CONVECTIVE WEATHER CHECKLIST

- Part A
  - Is a frontal or surface trof passage (lifting Mechanism) expected near max heating hours? Use model output and extrapolation to time passage.
  - Will the minimum solar heating necessary to initiate convection occur? Convective temperature (Tc) = CCL down dry-adiabatically to surface temperature.
  - Will the 850 mb dew point be $\geq$ 8 °C ? Consider current and forecasted values that may result due to advection and / or mixing.

# SEVERE CONVECTIVE WEATHER CHECKLIST

- Will the surface dewpoint be ≥ 60 ° F? Consider current and forecasted changes due to advection, insolation (convective mixing) and/or evaporation of surface moisture.
- Is upward vertical motion (PVA. OVV, Q-convergence) expected during period?
- Four or more yes (airmass thunderstorm probable) or three or more Yes with northwest flow proceed to part B, otherwise stop.

# SEVERE CONVECTIVE WEATHER CHECKLIST

- PART B
  - Is the approaching front or trof currently active? Consider the boundary's current level of convergence (lift) and what factors (slope, proximity to low-level jet, movement into more stable or unstable air, etc.) may change with time.
  - Will skies be clear enough to approach or realize max solar heating?
  - Will 850 mb wind over area be $\geq$ 20 kts?
  - Will the surface dew point be $\geq$ 65 °F?

# SEVERE CONVECTIVE WEATHER CHECKLIST

- Is strong vertical motion expected during period? Look for low-level convergence and/or high-level divergence, and moderate or greater WAA and/or CAA into the area. Will the forecast area be to the left of a $\geq$ 20kt low-level jet?
- Three or more Yes answer proceed to part C, otherwise stop.

# SEVERE CONVECTIVE WEATHER CHECKLIST

- PART C
  - Are lines of cumulus or middle clouds on the morning satellite pictures?  Consider all indications of existing instability (vertical motion) and mid-level moisture. Mid-level moisture will limit the potential destabilization of a conditionally unstable airmass.  Also, a mid level ceiling can limit surface heating and potential destabilization.
  - Are few or more organized thunderstorms currently in the area?

# SEVERE CONVECTIVE WEATHER CHECKLIST

- Is a thickness ridge (1000-500 mb or 1000-700 mb) expected to pass during period?
- Will there be upper level divergence (at or above 300 mb)? Consider current and forecasted areas of confluent/diffluent flow and speed changes. Will the forecast area be under the left front or right rear quadrant of a $\geq$ 70 kt upper-level (300mb) jet?
- Will there be CAA near 500 mb and /or WAA at or below 850mb? Will the atmosphere destabilize due to temperature or the latent heat of condensation or evaporation?

# SEVERE CONVECTIVE WEATHER CHECKLIST

- Will the 500 mb wind be ≥35 kt, and/or the horizontal wind shear ≥ 30 kts in 90 km during the period? Give consideration to amplification of 500 mb trough and/or transition of existing speed maximums.
- Is there a 700 mb no-change line upstream with winds crossing it at 40 □ or more?
  - This line represents neutral advection which occurs at the center of a thermal ridge or trough.
  - Advancement of a no-change line into a position ahead of a pronounced mid-level trough is associated with deepening/intensification of a surface low pressure centers.

# SEVERE CONVECTIVE WEATHER CHECKLIST

- The faster the no-change line is advected into the area, the greater the contribution to severe weather development.

- Is dry air intrusion at or near 700mb possible during the period? Check satellite moisture for potential mid-level drying?
- Is or will the 850 mb thermal ridge be over or to the west of the 850 mb moisture ridge?
- Is or will the severe weather indexes indicate the potential for severe weather?

# SEVERE CONVECTIVE WEATHER CHECKLIST

- Seven or more answer indicates severe weather is probable.  Less than seven, monitor marginal areas closely.

- APPLICATION:  Students will practice on appraisal packages in class
- EVALUATION:  A written measurement and progress check will be given at the end of the unit